Algorithmic Design and Virtual Reconstruction:

Innovating Architectural Heritage Virtual Reconstruction of the Roman Forum Transitorium in Musti, Tunisia

Introduction

As technology advances rapidly, professionals across diverse fields, including cultural heritage, must adapt to remain relevant. This is particularly critical for archaeologists, architects, and digital humanities experts who face the dual challenge of preserving historical accuracy while integrating innovative tools. Our project addresses this challenge using algorithmic design methods and interactive visualization to reconstruct the Roman Forum Transitorium in Musti, Tunisia. This approach provides multiple reconstruction scenarios and emphasizes the hypothetical nature of these models, fostering a more nuanced understanding of ancient structures.

Musti, an ancient Roman city in present-day Tunisia, was founded in the 2nd century BCE as a colony likely settled by Roman veterans. Located 130 km from Carthage and near el-Krib, Musti covers over 34 hectares and features extensive ruins, including temples, triumphal arches, Roman baths, and a Byzantine citadel. Recent archaeological work, part of a Polish-Tunisian collaboration, has unveiled numerous artifacts and inscriptions, shedding light on its history from Numidian origins through Roman and medieval times. This site offers significant insights into the urban development and cultural integration of Roman Africa. The Forum represents only a small fragment of the entire area, but an important one due to its central location.

Adapting to Technological Evolution:

In the face of AI and digital advancements, our project exemplifies how leveraging specialized skills and innovative tools can enhance the field of cultural heritage. By employing ARCHICAD, Rhino+Grasshopper, we have developed a Historic Building Information Modeling (HBIM) framework that goes beyond static representations. This approach ensures that our reconstructions remain relevant and adaptable to the evolving technological landscape.

Future-Oriented Reconstruction:

Unlike traditional static models that depict only one possible version of a historical site, our algorithmic design process allows for exploring multiple scenarios. We can dynamically adjust parameters using script-based simulations to reflect various historical interpretations. This method highlights the hypothetical nature of reconstructions and engages users by allowing them to interact with different potential outcomes. This flexibility is crucial in a field where the certainty of historical data is often in flux, making it clear to users that they interact with hypotheses rather than reconstruction understood as such.

Navigating Emerging Technologies:

Our project harnesses the power of cloud computing and globalized data storage to facilitate collaborative research and preservation efforts. By integrating photogrammetry and laser scanning methods, we ensure that our digital surveys are comprehensive and precise. These technologies enhance our models' accuracy and democratize access to high-quality digital heritage resources.

Innovative Educational and Presentation Approaches:

The project employs interactive visualization tools such as 3DVista and VR in response to the changing landscape of cultural heritage education and presentation. These platforms allow for immersive experiences that can transform how findings are presented in museums and archaeological sites. By enabling users to engage with multiple reconstruction scenarios, we foster a deeper understanding of the complexities and uncertainties inherent in historical interpretation. These scenarios, allowing user-based reconstruction, are crucial to understanding the hypothetical nature of virtual worlds related to the past.

Implications of Digitizing Cultural Heritage:

Our approach to dematerializing and digitizing cultural heritage emphasizes the importance of transparency in depicting the hypothetical nature of reconstructions. We clearly distinguish between verified historical facts and conjectural elements through interactive visualizations. This clarity is crucial in an era where social media and digital platforms can challenge the integrity of knowledge dissemination.

Conclusion:

This paper contributes to the dialogue on the future of cultural heritage by showcasing how algorithmic design and interactive technologies can be utilized to create more dynamic and accurate reconstructions. By emphasizing the hypothetical nature of our models and enabling user interaction, we offer a forward-thinking perspective that aligns with the themes of the International Conference on Cultural Heritage and New Technologies.

Keywords:

Algorithmic Design, Virtual Reconstruction, Cultural Heritage, Interactive Visualization, Historic Building Information Modeling (HBIM)

References

Champion, E.M., 2019. From Historical Models to Virtual Heritage Simulations, in: Kuroczyński, P., Pfarr-Harfst, M., Münster, S. (Eds.), Digitale 3D-Rekonstruktion Als Virtueller Raum Der Architekturhistorischen Forschung. Universitätsbibliothek Heidelberg, pp. 338–351.

Forte, M., 2015. Cyber Archaeology: A Post-virtual Perspective, in: Svensson, P., Goldberg, D.T. (Eds.), Between Humanities and the Digital. MIT Press, Cambridge, Mass., pp. 295–309.

Koszewski, K., 2021. Visual Representations in Digital 3D Modeling/Simulation for Architectural Heritage, in: Niebling, F., Münster, S., Messemer, H. (Eds.), Research and Education in Urban History in the Age of Digital Libraries. Springer International Publishing, Cham, pp. 87–105.

Misiewicz, K., Hajji, J. and Waliszewski, T. (2018) 'Prospections non invasives sur le site de Mustis/Musti (El Krib) en Tunisie', Światowit, 57, pp. 207-222. http://dx.doi.org/10.5604/01.3001.0013.6817

Mudička, Š., Kapica, R., 2022. Digital Heritage, the Possibilities of Information Visualisation through Extended Reality Tools. Heritage 6, 112–131. https://doi.org/10.3390/heritage6010006

Sławomir Kowal, Krzysztof Koszewski, Jan Słyk, S.W., 2017. Digital Method for Verifying Archaeological Hypotheses. Medieval Stronghold Under Pułtusk Castle. Studies in Digital Heritage 1, 444–455. https://doi.org/10.14434/sdh.v1i2.23412